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ABSTRACT

This study was designed to appraise the degree to which the vocational interest profiles of students in different academic majors can be classified into cogent clusters sharing a hierarchical organization. Students were administered the Jackson Vocational Interest Survey (JVIS) prior to their admission to college. Their choice of an academic major and their subsequent educational and career decisions were made without knowledge of their JVIS results. Mean scores for the 34 JVIS basic interest scales were obtained and standardized separately within sex for each of 64 academic majors in which 10 or more males were enrolled and for 67 academic majors in which 10 or more females were enrolled. Clusters in turn were organized hierarchically into more parsimonious, broader clusters. Implications for the psychology of occupational choice and career development are outlined. (Author/GK)

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Hierarchical Classification of Vocational Interest Associated with Academic Major Areas

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This study was designed to appraise the degree to which the vocational interest profiles of students in different academic major fields in a large, diverse university can be classified into cogent clusters sharing a hierarchical organization.

A major portion of the entering freshman class at the Pennsylvania State University was administered a battery of admission tests, including the Jackson Vocational Interest Survey (JVIS), after their acceptance but while still in high school. A total of 10,134 yielded complete JVIS records. Neither at that time, nor at any subsequent time did any of the students see their JVIS results or receive counseling based on these results. Thus, their subsequent educational or career decisions were made independently of knowledge of these results.

The present analyses are based on the JVIS profiles of 8,610 students, 4,889 males and 3,721 females, who had reached their senior year and who had designated a major area of specialization. The total sample size is, therefore, lowered by drop-outs, failure to specialize in a program and by majoring in a program with too few individuals of the same sex enrolled (generally 10 or less).

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A total of 131 groups were identified, comprising students enrolled in different academic major programs. Because there are systematic differences in vocational interests and in choice of a major for males and females, groups were designated separately by major and gender. Of the 131 major groups, there were 64 male groups and 67 female groups.

Method of Analysis

Individual scale scores for each of the 34 JVIS scales were standardized separately by sex, yielding male and female data matrices each having 34 scale means of zero with unit variances. A basis for clustering the vocational interest profiles of each of the 131 groups in terms of profile shape was required, one that could accommodate a relatively large data matrix and one relatively insensitive to measurement error.

The technique employed was originally used by Jackson and Williams (1975) and subsequently termed modal profile analysis by Skinner (1977). It involved a singular value decomposition of the 131 (groups) by 34 (scales) column and row standardized data matrix followed by orthogonal and oblique targetted rotation of axes. The salient projections on the axes defined by the right-hand eigenvectors postmultiplied by the diagonal matrix of singular values and a transformation matrix correspond to occupations clustering together based on their profile shape. With oblique rotation the degree of obliquity corresponds to the correlation between clusters, thus permitting hierarchical clustering. This procedure has been used with success previously to classify the mean vocational interest profiles of different occupational groups, and the personality profiles of hospitalized alcoholics (Skinner, Jackson, & Hoffmann, 1974) and of psychiatric patients and university students (Skinner, Reed, & Jackson, 1976).

The data matrix was decomposed using the singular decomposition routine described previously (Businger & Golub, 1969; Jackson, Skinner, & Strasburger, 1977). A total of 17 clusters were retained for interpretation, accounting for 95.75 percent of the total variance. The relatively large number of typal dimensions retained for interpretation was influenced by the fact that the data analyzed consisted of group means comprised of highly reliable aggregates of large numbers of entities.

Table 1 of the handout provides the obliquely rotated matrix of major groups and typal dimensions.

Table 2 lists the 17 clusters with the salient major groups associated with each. Groups are listed first, followed by the gender designation (M or F), and the index of association with the dimension, corresponding to a factor loading in factor analysis. Figure 1 shows a plot of two of these clusters.

Since typal dimensions were rotated obliquely, it was possible to evaluate the degree to which the clusters might be organized hierarchically and evaluated in terms of more general concepts. The cluster correlation matrix was therefore decomposed in a manner similar to that described for the first-order analysis, except in this case we operated on the correlations among first-order clusters, rather than on the groups directly. Table 3 contains the orthogonally rotated second-order cluster matrix.

Dimension I opposes Education and Performing Arts and Social Science. Education and Performing Arts share public presentation responsibilities. As well, the first-order Performing Arts cluster contained Music Education major groups. Dimension II primarily implicates science clusters, except for Mathematical Sciences and Engineering. Dimension III opposes Communicative

Arts and Business with Social Service, Mathematical Sciences, Behavioral Sciences and Engineering. Dimension IV places Environmental Resource Management and Health, Physical Education and Recreation at the opposite pole from Health Services, an empirical finding which merits further evaluation. Dimension V primarily identifies Food Science, while Dimension VI links Behavioral Science with Social Science and opposes these to Agricultural Business. Figure 2 shows a plot of two of these clusters.

Discussion

It is reassuring to note the degree to which vocational interest profiles of students in various specialties conform to a priori expectations. Individuals in various health service fields do share similar likes and dislikes as characterized, for example, not only by high interests in life science, but also by less pronounced interests in Business and in various interpersonal activities. Where apparently diverse groups cluster, as for example in the clustering of Theatre Arts with English Majors and various Modern Language groups, their interest patterns are characterized by a common emphasis on communication arts--as captured in the JVIS scale for Performing Arts, for example.

Unlike many other studies, the predictive validity or classification efficiency of JVIS profiles with regard to choice of an educational major were not subject to the criticism of "criterion contamination," as represented, for example, by a student's entering engineering because the JVIS results suggested it.

The cogency of the present results suggests that a clustering approach to identifying characteristic vocational interest profiles may represent an advance over the common practice in vocational counseling of reporting an individual's similarity to a particular student major or occupational group. There are three advantages of the use of clusters over individual groups: (a) Due to the exigencies of sampling, individual occupational or student groups may not be representative of the class in which it is intuitively placed. Indeed, in the present results one can find instances of outliers among academic major groups, whose interest profile is not characteristic of the average profiles of the group to which it might be expected to belong; (b) Clusters permit a broader psychological basis for understanding the nature of the grouping as, for example, in the kinship of the profiles for majors in Law Enforcement and Corrections with profiles for majors in different social sciences. Thus, an individual contemplating entering a major field related to a cluster but not one of its constituent groups might have a stronger basis for generalizing the interpretation of the cluster than he or she might have for generalizing profile similarity with a particular single major group; (c) Clusters are simply more parsimonious. It would be profligate of computer and counseling time to report an individual's similarity to the 131 student major groups employed in our study given the fact that 95 percent of their variance can be better represented by 17 clusters.

A particularly contentious issue in contemporary vocational interest measurement is the interpretation of sex differences and what they might or might not imply about equal access to jobs. The results from this analysis are consistent with observations made in the literature (Prediger, 19).

There is converging evidence that greater comparability in vocational interest profiles will be achieved by standardizing scales separately within each sex. This has the effect of reducing or eliminating mean differences due to gender. It is noteworthy that our results in general yielded quite similar profiles for males and females majoring in the same area. There was a marked tendency for males and females in a common major to be clustered together empirically. Every one of the 17 clusters was defined by both male and female major groups. Of course, for many of our groups there was not a sufficient number of one gender or the other to yield us two distinct gender groups; there remains a considerable imbalance in the preferences of males and females for different academic majors.

A word would be appropriate about the unipolar nature of the typal dimensions on which we based the clustering. In some past studies (e.g., Skinner, Jackson, & Hoffmann, 1974) typal dimensions were bipolar, with clusters being represented at each pole of each dimension. In the case of vocational interests, the representation of clusters in this way would probably be more confusing than enlightening, since the negative pole of a typal dimension would represent interests opposite to that represented on the positive pole. For this reason we elected to extract a somewhat larger number of dimensions than might have been dictated purely by parsimony. This has the effect of largely eliminating the bipolarity with its associated interpretive difficulties.

It is noteworthy that even though we permitted oblique orientation of reference axes, typal dimensions were not highly correlated. The second order dimensions which did emerge again conformed to a priori expectations reasonably well; the various science groups did form a cogent

higher-order cluster, primary factors for Performing Arts tended to be allied with Communication Arts, and Agricultural Business Management did show a tendency to be associated with the Business cluster. Equally interesting were the tendencies for the Food Science cluster and the Health Services cluster to be represented as distinct dimensions at the second order.

The present results are encouraging from the point of view of the classification of different groups in terms of interest patterns. They might also encourage further exploration into the nature of work and motivation. In regard to the reasons for an individual choosing a particular field of study or career, we have indicated that interests play an important role in such choices. But future classification studies might take into account not only interests, but also other bases for such choices, including individual and societal values, as well as perceived intrinsic and extrinsic rewards, including monetary, interpersonal, status-related, and others. Abilities have been also traditionally considered to be important in student and personnel classification. A complete basis for classification would have to take into account these individual domains as well as perceived and actual opportunities for success. The present large scale analysis suggests that such a more ambitious classification undertaking is not beyond the realm of present capability. Vocational counseling and informed individual decision making of necessity takes into account the appropriate individual weights assignable to variables within each of the above domains. Empirical analyses of the bases for such decision making might do much to explicate more clearly and parsimoniously the appropriate variables, thus permitting more rational individual and institutional decision making.

Summary and Conclusions

1. A set of profiles of 131 university academic major groups representing their mean vocational interests could be represented parsimoniously in 17 clusters each sharing similar profile shapes.
2. When initial mean gender differences are taken into account, male and female academic major profiles showed a marked tendency to be clustered in a similar manner. All 17 clusters were defined by both male and female groups.
3. Hierarchical clustering yielded six higher-order dimensions, which provide a super-ordinate classificational system. The more abstract bases for certain of these dimensions suggests that primary dimensions will probably prove more useful.
4. It is recommended that further studies of educational and occupational classification include not only vocational interests, but other bases for occupational choice, including abilities, personality, values, and perceived opportunities.

TABLE 1 - OBLIQUELY ROTATED CLUSTER LOADINGS

MAJOR	SEX	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
AGRICULTURAL BUSINESS MANAGEMENT	M	27	.47	.41	-.04	.21	.02	-.14	.16	-.04	-.24	-.01	-.19	.33	-.17	-.02	-.10	.04	-.03
AGRICULTURAL ECONOMICS + RURAL SOCIOLOGY	M	7	.60	.18	-.14	-.08	.04	-.06	.02	.09	.15	.04	-.29	-.05	-.11	.06	.14	.12	.13
AGRICULTURAL MECHANIZATION	M	14	.09	.15	.10	-.01	-.20	.11	.20	.01	-.32	-.04	-.21	.06	0.00	-.13	.09	-.19	-.10
AGRICULTURE	M	601	.07	.39	.05	.11	-.11	-.07	.29	-.12	-.21	.07	-.02	-.09	.02	-.14	-.09	-.04	-.06
AGRONOMY	M	25	.06	.28	.03	.12	.05	-.14	.29	0.00	-.26	.03	-.02	-.08	-.22	-.08	0.00	.01	-.04
ANIMAL PRODUCTION	M	14	-.05	.21	-.10	.01	-.17	-.03	.42	-.11	-.14	.16	.06	-.03	-.17	-.11	-.11	-.12	-.03
ANIMAL SCIENCE	M	36	.09	.06	-.05	-.08	.08	-.18	.30	.04	-.19	.17	.26	-.18	-.15	-.10	-.07	-.13	-.04
ENVIRONMENTAL RESOURCE MANAGEMENT	M	80	-.01	.36	-.16	.13	-.01	-.01	.15	.08	-.01	.10	-.02	-.27	-.02	-.06	-.13	-.06	0.00
FOOD SCIENCE	M	11	-.06	.05	-.06	-.09	.08	-.01	.31	-.18	-.34	.26	.23	-.10	.04	.06	-.07	-.02	.04
FOREST SCIENCE + TECHNOLOGY	M	109	.06	.31	-.05	.13	-.05	-.04	.24	.04	-.20	.03	-.04	-.19	-.07	-.10	-.05	-.02	-.03
HORTICULTURE	M	39	.22	.29	-.06	0.00	-.15	-.14	.37	.06	-.11	-.12	0.00	.02	-.24	-.20	-.11	-.06	-.16
2YR. WILDLIFE TECHNOLOGY	M	28	.07	.34	-.04	.12	-.11	-.01	.28	-.05	-.29	.01	-.09	-.17	.03	-.06	-.14	-.12	-.02
ARCHITECTURE	M	25	-.10	-.01	-.03	-.13	.21	-.01	-.17	.53	-.05	-.08	-.02	-.12	-.16	-.14	-.09	.05	-.07
ART	M	31	-.04	.05	.01	.04	0.00	-.07	-.15	.36	.17	-.15	-.09	-.32	-.02	-.33	.19	.01	.10
LANDSCAPE ARCHITECTURE	M	25	-.09	.08	-.12	.03	.16	.06	-.22	.58	.09	-.33	-.05	.05	.05	-.18	-.06	-.05	.07
THEATRE ARTS	M	11	-.10	-.14	.16	-.07	-.02	-.13	-.17	.06	.39	-.04	-.09	-.25	.11	-.01	.30	-.14	.13
ACCOUNTING	M	130	.04	-.13	.04	-.06	-.03	-.07	-.12	-.13	.09	-.08	-.02	.44	-.10	.09	-.04	.20	-.13
BUSINESS, ADMINISTRATION + MANAGEMENT	M	755	.06	-.09	0.00	.03	-.04	-.02	-.17	-.10	.08	-.10	-.04	.43	-.03	.15	-.03	.13	-.09
FINANCE	M	49	.20	-.19	-.11	-.08	-.13	.04	-.11	-.04	.09	-.13	-.01	.52	-.04	.18	-.14	-.06	-.17
ADVERTISING	M	26	.03	-.02	-.04	.06	-.18	-.12	-.11	-.06	.38	-.11	-.06	.21	-.04	.07	.05	.03	-.02
EARTH + MINERAL SCIENCES	M	190	-.02	.01	-.12	-.05	0.00	.19	.09	-.06	-.05	.24	.11	-.18	0.00	-.11	.04	.05	-.09
EDUCATION	M	99	.06	-.15	.24	-.14	.06	-.20	-.16	-.07	.03	-.26	-.04	.18	.01	-.06	-.05	.26	-.05
ELEMENTARY + KINDERGARTEN EDUCATION	M	14	-.10	0.00	.35	-.05	.21	-.14	-.03	-.17	-.08	-.21	-.21	-.11	.08	.10	-.07	.01	.23
MUSIC EDUCATION	M	17	.08	-.13	.39	.14	.14	-.03	-.16	-.14	.29	.13	-.11	-.07	-.09	-.11	.61	-.01	.07
SECONDARY EDUCATION	M	20	-.02	-.16	.45	.01	.18	-.10	-.03	-.20	-.04	-.11	-.09	.16	-.17	-.06	.15	.08	.04
VOCATIONAL INDUSTRIAL EDUCATION	M	10	-.18	.07	.21	.20	-.22	.05	.10	.04	-.43	-.27	-.08	.16	.02	-.02	-.15	-.09	-.02
ARCHITECTURAL ENGINEERING	M	39	.09	-.17	-.29	.07	-.01	.42	-.27	.50	-.13	-.12	0.00	.21	-.12	-.04	-.16	-.01	-.10
CHEMICAL ENGINEERING	M	94	-.12	-.09	-.03	-.02	.05	.30	.13	-.12	-.13	.32	.07	-.02	-.17	-.04	.02	.02	-.07
CIVIL ENGINEERING	M	112	-.01	0.00	-.04	.03	.16	.40	-.18	.13	-.20	.10	-.13	.05	-.01	-.05	.01	.11	-.13
ELECTRICAL ENGINEERING	M	142	-.10	-.03	-.02	-.02	.08	.25	.01	0.00	-.15	.19	-.01	-.01	-.16	-.12	.03	.20	-.09
ENGINEERING	M	199	-.01	-.04	-.14	.01	.12	.38	-.10	.12	-.15	.14	-.05	-.07	-.01	-.08	-.06	.09	0.00
ENGINEERING SCIENCE	M	34	-.13	-.16	.03	-.12	.01	.27	-.04	.06	-.01	.15	0.00	.02	-.18	.03	-.03	.01	-.22
INDUSTRIAL ENGINEERING	M	61	.07	-.29	.04	-.12	.11	.36	-.03	-.11	-.18	.03	-.03	.49	-.09	-.04	.03	.08	-.09
MECHANICAL ENGINEERING	M	116	-.09	.03	-.12	.02	-.01	.35	-.04	.01	-.26	.14	-.11	.10	-.03	.01	-.06	.12	-.10
ARCHITECTURAL ENGINEERING TECHNOLOGY	M	21	-.10	-.16	-.01	-.06	-.12	.18	-.12	.20	-.24	-.21	-.05	.21	.01	-.24	-.04	.18	-.03
ENGINEERING TECHNOLOGIES	M	389	-.08	.06	-.08	.05	-.06	.20	.10	.01	-.19	.08	-.01	-.02	-.11	-.17	0.00	.12	-.07
HEALTH + PHYSICAL EDUCATION	M	27	-.06	.30	.04	.54	-.32	-.07	.05	-.13	.21	-.20	-.01	.08	-.13	-.23	.09	.19	-.08
RECREATION + PARKS	M	57	.13	.48	-.07	.36	-.25	-.06	.17	-.04	-.04	-.17	-.18	-.19	.07	-.18	-.09	0.00	.10
FOOD SERVICE + HOUSING ADMINISTRATION	M	50	.19	-.10	-.06	.21	-.20	.06	-.16	0.00	.14	-.23	.02	.46	-.04	-.13	.03	.07	-.08
HEALTH PLANNING + ADMINISTRATION	M	21	.02	-.33	-.13	-.09	-.06	-.19	.18	-.13	-.07	.10	.53	.40	.06	.12	.02	-.06	-.01
HUMAN DEVELOPMENT	M	21	-.07	.01	-.27	.15	-.21	-.05	-.27	-.10	.29	.14	.05	.01	.25	.38	-.05	.01	-.02
INDIVIDUAL + FAMILY STUDIES	M	19	.06	.02	.09	.21	.04	.01	-.17	.11	-.13	-.26	-.03	-.27	.43	-.11	.08	-.13	.23
LAW ENFORCEMENT + CORRECTIONS	M	104	-.04	-.04	-.05	.04	-.21	.01	-.14	-.21	-.01	-.12	-.08	.08	.37	.29	-.06	-.08	0.00
ENGLISH	M	22	-.07	-.08	.05	-.09	-.11	-.19	-.13	.16	.38	-.02	-.04	-.24	.03	.06	.15	-.20	.04
MODERN LANGUAGES	M	17	.01	-.09	-.07	.01	.09	.01	-.26	-.02	.32	-.16	-.01	-.13	.21	.12	-.04	-.05	.04
GENERAL ARTS + SCIENCE	M	41	.02	-.09	.18	.18	-.06	-.06	-.18	.03	.10	.02	.19	-.36	.16	-.20	.28	.10	-.07
HISTORY	M	19	-.03	-.02	.04	-.06	.02	-.08	-.12	-.15	.25	-.10	-.14	-.02	.16	.29	-.02	-.12	01
JOURNALISM	M	62	0.00	-.05	.01	-.10	-.03	-.23	-.13	0.00	.30	-.11	-.07	-.01	.06	.15	.03	.01	.09
LIBERAL ARTS	M	162	-.03	-.07	-.08	-.05	-.04	-.15	-.20	.11	.34	-.10	-.01	.03	.10	.25	0.00	-.09	0.00
POLITICAL SCIENCE	M	43	-.01	-.11	-.05	-.11	-.10	-.05	-.18	-.06	.19	-.02	-.04	.05	.22	.35	0.00	-.11	-.02
PRELAW	M	38	-.03	-.13	-.06	-.07	-.05	-.06	-.15	-.06	.20	-.09	-.01	.21	.10	.26	-.06	-.06	-.02
PSYCHOLOGY	M	50	-.19	.02	-.16	-.04	-.06	.04	-.02	0.00	.03	.02	.06	-.26	.43	.25	-.21	-.26	.23
SOCIAL WELFARE	M	6	-.04	0.00	.01	-.02	.13	-.11	.01	.02	.06	-.04	-.02	-.34	.24	-.04	.09	-.04	.50
SOCIOLOGY	M	9	.01	-.11	-.02	-.13	.04	0.00	.19	.06	.06	-.15	.13	-.04	.24	-.11	.03	-.44	.02
SPEECH COMMUNICATION	M	29	-.02	-.08	.09	.01	0.00	-.17	-.11	.01	.30	-.08	-.08	.09	-.02	.15	.16	-.12	.05

TABLE 1 - OBLIQUELY ROTATED CLUSTER LOADINGS

MAJOR	SEX	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
BIOCHEMISTRY, BIOPHYSICS +MICROBIOLOGY	M	62	-.17	-.09	-.05	-.11	.09	-.03	.11	-.01	-.03	.29	.38	-.13	-.05	-.05	-.07	.01	-.14
BIOLOGY	M	129	-.01	.08	-.16	.02	-.03	.01	.25	-.03	-.06	.17	.27	-.15	-.05	-.13	-.10	-.03	-.05
CHEMISTRY	M	24	-.27	0.00	.03	-.07	.24	.02	.07	-.04	.02	.30	.18	-.21	-.14	-.02	.08	.16	-.12
COMPUTER SCIENCE	M	84	.06	-.11	.08	.04	.23	.25	-.07	-.11	-.05	.18	-.02	.15	-.28	-.13	.10	.38	-.07
PHYSICS	M	16	-.10	-.18	.06	-.24	.33	.04	.04	.01	-.13	.28	.16	-.23	-.11	.04	-.01	.08	.09
MATHEMATICS	M	10	-.04	-.21	.16	-.15	.52	.19	-.20	-.05	-.17	-.03	-.13	-.20	.02	.18	-.14	.18	.25
PREMEDICINE	M	57	-.04	-.25	0.00	-.10	.06	-.09	.18	-.04	-.19	.29	.53	-.03	-.09	-.10	-.04	-.05	-.15
SCIENCE	M	70	.01	.07	-.24	.01	.01	.09	.20	-.15	-.24	.37	.24	-.07	.06	.03	-.12	.04	.04
2YR. COMPUTER SCIENCE	M	40	-.06	-.02	.06	-.07	.04	.12	-.13	-.09	-.14	.20	-.09	.06	-.16	-.12	.07	.47	-.09
AGRICULTURAL BUSINESS MANAGEMENT	F	10	.43	0.00	-.06	-.23	.24	.03	.13	-.06	-.09	-.07	-.05	.17	-.03	-.10	-.10	-.12	-.08
AGRICULTURAL ECONOMICS + RURAL SOCIOLOGY	F	10	.45	.13	-.06	-.10	-.04	-.18	.17	-.02	-.06	-.10	.16	.13	.11	-.17	-.23	-.16	-.04
AGRICULTURE	F	313	-.03	.29	.06	.09	-.04	-.07	.32	-.18	-.26	.09	.06	-.24	-.02	-.19	-.09	-.03	.07
ANIMAL PRODUCTION	F	20	.05	.10	.05	.01	-.09	-.03	.29	-.13	-.15	.17	.11	-.08	-.07	-.22	.06	-.14	-.12
ANIMAL SCIENCE	F	40	.03	.12	-.07	.03	-.11	-.16	.25	-.02	-.13	.20	.24	-.17	-.15	-.05	-.07	0.00	-.17
ENVIRONMENTAL RESOURCE MANAGEMENT	F	38	-.09	.47	-.03	.20	-.05	-.02	.22	-.08	-.04	.15	-.09	-.21	-.08	-.08	-.06	-.02	-.08
FOOD SCIENCE	F	12	.12	.02	-.04	.03	-.18	.19	.37	-.25	.13	.17	.02	-.03	-.05	-.20	.19	-.14	.01
FOREST SCIENCE + TECHNOLOGY	F	16	.03	.30	-.04	.09	-.07	.06	.16	.02	-.16	.08	-.11	-.25	.04	-.15	-.02	-.06	0.00
HORTICULTURE	F	51	-.01	.31	-.05	.04	-.10	-.14	.25	.05	.12	.02	-.05	-.16	-.21	-.27	.05	.05	-.03
2YR. WILDLIFE TECHNOLOGY	F	6	-.10	.53	-.06	.07	-.07	-.21	.22	-.08	-.07	.07	-.13	-.30	.02	.12	-.17	-.05	-.14
ARCHITECTURE	F	9	-.06	.03	-.20	-.17	-.15	.14	-.10	.47	.06	-.19	-.22	-.16	0.00	-.08	-.04	.11	.06
ART	F	63	-.12	-.04	-.13	.08	-.14	-.05	-.23	.59	.20	-.15	.04	-.08	-.05	-.05	.02	-.31	-.17
LANDSCAPE ARCHITECTURE	F	15	-.10	.09	-.14	-.18	-.04	-.04	-.07	.45	-.13	-.06	-.08	-.19	.04	.15	-.06	-.22	-.19
ACCOUNTING	F	48	0.00	-.21	.12	-.12	.08	-.05	-.15	-.03	-.04	-.16	-.02	.39	-.08	.03	-.09	.17	-.09
BUSINESS, ADMINISTRATION + MANAGEMENT	F	382	-.01	-.08	.07	-.01	.01	-.05	-.07	-.13	.05	-.14	-.06	.39	-.10	.11	-.11	.17	-.06
FINANCE	F	11	.14	-.13	0.00	-.10	.11	-.05	-.11	.12	-.15	-.25	-.03	.48	-.02	.05	-.14	.06	.04
ADVERTISING	F	43	.06	-.04	0.00	.07	-.09	-.04	-.20	-.08	.42	-.03	-.08	.07	.02	.11	.12	-.08	-.05
EARTH + MINERAL SCIENCES	F	32	0.00	.06	.03	-.06	.09	.14	.14	-.17	-.11	.26	-.03	-.10	-.15	.02	.08	-.01	-.18
ART EDUCATION	F	18	-.19	.10	.03	.06	-.08	.06	.01	.34	.08	-.24	-.18	-.32	.02	-.17	.10	-.29	.11
EDUCATION	F	470	.08	-.08	.38	-.14	.14	-.32	-.05	-.12	-.08	-.25	-.10	.06	0.00	-.17	.02	.21	.09
EDUCATION OF EXCEPTIONAL CHILDREN	F	57	-.09	-.01	.21	.09	.17	-.16	0.00	.01	-.14	-.19	-.02	-.29	.16	-.09	.06	.04	.45
ELEMENTARY + KINDERGARTEN EDUCATION	F	100	-.07	-.03	.32	.12	.08	-.18	-.05	-.04	-.03	-.33	-.09	.03	-.03	-.07	0.00	.03	.13
MUSIC EDUCATION	F	11	-.16	-.03	.28	.04	-.09	.14	.02	-.18	.08	.08	-.27	.02	-.06	-.30	.57	.09	.05
REHABILITATION EDUCATION	F	38	.02	-.08	.17	.02	.03	-.13	.02	-.15	-.22	-.19	-.05	-.02	.27	.02	.04	-.03	.32
SECONDARY EDUCATION	F	34	-.16	-.08	.38	.03	-.03	-.15	.01	-.19	.26	-.12	-.07	-.14	-.17	-.12	.21	-.02	-.02
SPEECH PATHOLOGY + AUDIOLOGY	F	62	-.18	.05	.25	.10	.20	-.23	.07	-.01	-.12	-.11	.01	-.24	.13	-.01	.10	-.06	.34
ARCHITECTURAL ENGINEERING	F	18	.22	-.13	-.09	-.11	.22	.38	-.29	.43	-.17	-.10	-.20	.02	-.04	-.04	-.14	-.11	-.02
CHEMICAL ENGINEERING	F	18	-.04	-.06	-.11	-.10	.05	.36	.06	-.02	-.12	.21	.01	-.03	.07	-.13	.14	-.04	-.02
CIVIL ENGINEERING	F	12	-.16	-.11	0.00	-.16	-.07	.40	-.06	.08	-.25	.06	-.18	.14	.07	-.08	.08	-.13	-.11
ELECTRICAL ENGINEERING	F	8	-.10	.01	-.04	-.08	-.03	.31	-.09	.07	-.09	.07	-.13	-.02	-.03	.05	-.16	.22	-.13
ENGINEERING	F	18	-.04	-.03	-.22	.09	.20	.50	-.18	.07	-.21	.17	-.03	-.03	.13	.08	.03	.23	.11
ENGINEERING SCIENCE	F	7	-.07	-.15	-.02	-.10	.31	.18	-.09	.07	-.11	.32	.11	-.10	-.12	.14	-.02	-.03	-.12
INDUSTRIAL ENGINEERING	F	23	.03	-.14	-.11	-.06	-.05	.46	-.12	-.02	-.27	-.10	-.08	.40	.21	.14	-.10	-.01	-.14
MECHANICAL ENGINEERING	F	14	-.02	-.07	-.02	-.08	.15	.42	-.19	.05	-.12	0.00	-.09	.05	.03	-.16	-.11	.09	-.16
ARCHITECTURAL ENGINEERING TECHNOLOGY	F	6	.06	-.14	-.09	.08	-.06	.10	-.21	.27	-.21	0.00	.05	.10	-.21	-.13	-.03	.28	-.01
ENGINEERING TECHNOLOGIES	F	24	-.08	.10	-.05	.18	-.03	.25	.14	-.14	-.22	.02	-.01	-.17	-.01	-.10	-.10	.09	-.01
HEALTH + PHYSICAL EDUCATION	F	49	.04	.10	.02	.50	-.11	.08	.01	.02	-.23	-.25	.11	.08	.10	-.10	-.04	-.14	-.01
RECREATION + PARKS	F	78	0.00	.32	.08	.50	-.20	-.11	.09	-.09	.11	.16	-.09	-.11	-.13	-.05	.18	.03	.12
FOOD SERVICE + HOUSING ADMINISTRATION	F	40	.41	-.09	-.06	.15	-.15	-.05	.11	.01	-.04	-.28	.07	.50	-.11	-.10	.02	-.10	-.01
HEALTH PLANNING + ADMINISTRATION	F	49	.13	-.18	-.16	.13	-.06	-.05	.07	-.17	-.02	.08	.41	.23	.15	.12	-.11	-.21	.03
HUMAN DEVELOPMENT	F	34	.01	-.17	-.12	0.00	-.14	-.10	.12	-.09	-.12	-.31	.22	.14	.23	-.03	-.16	.01	.25
INDIVIDUAL + FAMILY STUDIES	F	173	-.01	.02	.06	.11	.03	-.04	-.09	-.05	-.05	-.30	-.08	-.08	.31	-.03	-.03	-.02	.34
LAW ENFORCEMENT + CORRECTIONS	F	89	-.04	-.04	-.09	.07	-.14	.05	-.22	-.13	-.06	-.03	-.04	.10	.38	.35	-.12	-.06	.06
NURSING	F	119	-.03	-.13	.01	-.02	-.05	-.17	.31	-.08	-.35	.09	.42	-.08	.13	-.15	-.02	-.01	.14
NUTRITION	F	57	.02	.12	.01	.11	.09	-.09	.39	-.07	-.20	-.03	.24	.12	-.11	-.25	-.17	.19	.23
2YR. RETAILING	F	16	.08	-.03	.02	.16	-.01	.03	0.00	.08	.01	-.41	-.10	.27	-.14	-.18	-.11	.01	.15

TABLE 1 - OBLIQUELY ROTATED CLUSTER LOADINGS

MAJOR	SEX	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
ENGLISH	F	30	.02	.06	-.07	.05	-.20	-.18	-.16	.04	.53	.06	-.05	-.13	-.06	.19	.03	-.08	-.13
MODERN LANGUAGES	F	49	-.06	.14	.02	.32	-.21	.06	-.17	-.02	.56	-.16	-.11	.16	.02	.11	.06	-.06	-.34
GENERAL ARTS + SCIENCE	F	51	.05	-.12	.03	-.20	.04	-.12	-.12	-.05	.30	.15	.02	-.01	.26	.10	.25	-.17	.07
HISTORY	F	10	-.13	-.04	-.12	-.10	-.19	-.13	-.06	.02	.28	-.17	-.08	.02	.05	.43	-.09	-.17	-.11
JOURNALISM	F	87	0.00	-.03	.04	-.04	-.07	-.23	-.10	-.08	.43	-.05	-.07	.06	-.12	.13	.05	.02	-.06
LIBERAL ARTS	F	172	.02	-.07	-.06	-.07	-.07	-.06	-.17	-.03	.29	-.08	-.07	.05	.20	.25	.03	-.10	.03
POLITICAL SCIENCE	F	31	-.02	-.14	-.06	-.13	.02	-.03	-.14	-.03	.16	-.04	-.02	.11	.14	.35	-.09	-.16	.01
PRELAW	F	15	-.11	-.04	-.09	0.00	.06	-.08	-.22	-.11	.18	.14	-.04	-.11	.13	.53	-.11	.02	.01
PSYCHOLOGY	F	65	-.07	-.20	.05	-.14	.06	.07	-.13	-.18	-.17	.01	0.00	-.08	.42	.09	.14	.07	.35
SOCIAL WELFARE	F	50	.05	-.04	.02	.02	.05	-.05	-.13	-.04	.14	-.24	-.08	.08	.18	.07	-.03	.02	.20
SOCIOLOGY	F	21	-.03	-.14	.01	-.14	.07	-.11	-.21	.06	.02	-.27	-.05	-.05	.34	.21	-.07	-.12	.15
SPEECH COMMUNICATION	F	36	.03	-.06	.07	-.06	-.01	-.19	-.09	-.08	.41	-.01	-.11	.10	-.09	.13	.23	-.03	.01
BIOCHEMISTRY, BIOPHYSICS + MICROBIOLOGY	F	99	-.04	.03	-.10	.02	.06	-.02	.25	-.10	-.15	.31	.37	-.10	-.10	-.09	-.13	.05	-.05
BIOLOGY	F	85	.03	.08	-.14	-.08	.06	-.11	.28	-.06	-.05	.31	.28	-.22	-.09	-.04	-.06	-.01	.03
CHEMISTRY	F	16	-.02	-.05	.01	-.16	.08	-.01	.18	-.08	-.03	.37	.11	-.10	-.24	.13	.05	-.10	-.13
COMPUTER SCIENCE	F	39	-.07	.04	.06	.04	.13	.14	-.04	-.12	-.18	.05	-.07	.04	-.20	-.15	-.13	.55	.06
MATHEMATICS	F	9	.11	-.11	.10	-.17	.39	.07	-.08	.16	-.22	0.00	.04	.26	-.05	-.29	.13	.14	-.03
PREMEDICINE	F	17	-.18	-.10	-.13	-.02	.10	-.14	.11	0.00	-.03	.41	.47	-.20	-.16	0.00	-.07	.09	-.13
SCIENCE	F	38	-.01	.06	-.11	.05	-.19	-.03	.06	.02	.06	.53	.21	-.13	-.08	-.05	.06	.06	-.07
2YR. COMPUTER SCIENCE	F	24	-.01	-.10	.08	.06	.10	-.04	-.10	.03	-.19	-.15	.05	.29	-.11	-.07	-.06	.38	.09
THEATRE ARTS	F	15	0.00	-.11	.11	.02	-.07	-.28	-.13	.03	.64	.17	.07	-.26	-.12	-.07	.52	.02	-.04

Table 2

First-Order Clusters

Cluster 1 Agricultural Business		
Agricultural Economics and Rural Sociology	M	.60
Agricultural Business Management	M	.47
Agricultural Economics and Rural Sociology	F	.45
Agricultural Business Management	F	.43
Food Service and Housing Administration	F	.41

Cluster 2 Environmental Resource Management		
2 yr. Wildlife Technology	F	.53
Recreation and Parks	M	.48
Environmental Resource Management	F	.47
Agricultural Business Management	M	.41
Agriculture	M	.39
Environmental Resource Management	M	.36
2 yr. Wildlife Technology	M	.34
Recreation and Parks	F	.32
Forest Science and Technology	M	.31
Horticulture	F	.31
Health and Physical Education	M	.30
Forest Science and Technology	F	.30

Cluster 3 Education		
Secondary Education	M	.45
Music Education	M	.39
Secondary Education	F	.38
Education	F	.38
Elementary and Kindergarten Education	M	.35
Elementary and Kindergarten Education	F	.32

Cluster 4 Health, Physical Education and Recreation		
Health and Physical Education	M	.54
Health and Physical Education	F	.50
Recreation and Parks	F	.50
Recreation and Parks	M	.36

Cluster 5 Mathematical Sciences		
Mathematics	M	.52
Mathematics	F	.39
Physics	M	.33
Engineering Science	F	.31

Cluster 6 Engineering		
Engineering	F	.50
Industrial Engineering	F	.46
Architectural Engineering	M	.42
Mechanical Engineering	F	.42
Civil Engineering	M	.40
Civil Engineering	F	.40
Architectural Engineering	F	.38
Engineering	M	.38
Industrial Engineering	M	.36
Chemical Engineering	F	.36
Mechanical Engineering	M	.35
Electrical Engineering	F	.31

Cluster 7 Food Science		
Animal Production	M	.42
Nutrition	F	.39
Horticulture	M	.37
Food Science	F	.37
Agriculture	F	.32
Food Science	M	.31
Nursing	F	.31
Animal Science	M	.30

Cluster 8 Art and Architecture		
Art	F	.59
Landscape Architecture	M	.58
Architecture	M	.53
Architectural Engineering	M	.50
Architecture	F	.47
Landscape Architecture	F	.45
Architectural Engineering	F	.43
Art	M	.36
Art Education	F	.34

Cluster 9 Communicative Arts		
Theatre Arts	F	.64
Modern Languages	F	.56
English	F	.53
Journalism	F	.43
Advertising	F	.42
Speech Communication	F	.41
Theatre Arts	M	.39
Advertising	M	.38
English	M	.38
Liberal Arts	M	.34
Modern Languages	M	.32
Speech Communication	M	.30
Journalism	M	.30

Table 2 (Continued)

Cluster 10 Science		
Science	F	.53
Premedicine	F	.41
Science	M	.37
Chemistry	F	.37
Engineering Science	F	.32
Chemical Engineering	M	.32
Biochemistry, Biophysics and Microbiology	F	.32
Biology	F	.31

Cluster 11 Health Services		
Health Planning and Administration	M	.53
Premedicine	M	.53
Premedicine	F	.47
Nursing	F	.42
Health Planning and Administration	F	.41
Biochemistry, Biophysics and Microbiology	M	.38
Biochemistry, Biophysics and Microbiology	F	.37

Cluster 12 Business		
Finance	M	.52
Food Service and Housing Administration	F	.50
Industrial Engineering	M	.49
Finance	F	.48
Food Service and Housing Administration	M	.46
Accounting	M	.44
Business, Administration and Management	M	.43
Industrial Engineering	F	.40
Health Planning and Administration	M	.40
Business, Administration and Management	F	.39
Accounting	F	.39
Agricultural Business Management	M	.33

Cluster 13 Behavioral Science		
Psychology	M	.43
Individual and Family Studies	M	.43
Psychology	F	.42
Law Enforcement and Correction	F	.38
Law Enforcement and Correction	M	.37
Sociology	F	.34
Individual and Family Studies	F	.31

Cluster 14 Social Science		
Prelaw	F	.53
History	F	.43
Human Development	M	.38
Political Science	F	.35
Law Enforcement and Correction	F	.35
Political Science	M	.35

Cluster 15 Performing Arts		
Music Education	M	.61
Music Education	F	.57
Theatre Arts	F	.52
Theatre Arts	M	.30

Cluster 16 Computer Science		
Computer Science	F	.55
Two Year Computer Science	M	.47
Two Year Computer Science	F	.38
Computer Science	M	.38

Cluster 17 Social Service		
Social Welfare	M	.50
Education of Exceptional Children	F	.45
Psychology	F	.35
Speech Pathology and Audiology	F	.34
Individual and Family Studies	F	.34
Rehabilitation Education	F	.31

Table 3

Second Order Varimax Cluster Rotation

	Cluster					
	I	II	III	IV	V	VI
Agricultural Business	.08	-.05	.10	-.07	-.07	-.86
Environmental Resource Management	-.21	.15	-.07	-.89	-.17	-.09
Education	.89	-.16	.06	-.11	-.17	-.19
Health, Physical Education and Recreation	-.34	.25	-.24	-.56	.40	-.10
Mathematical Sciences	.36	-.03	.60	.10	.33	-.31
Engineering	-.19	-.14	.34	-.14	.49	.39
Food Science	-.03	-.16	.01	-.03	-.93	-.16
Art and Architecture	-.22	-.43	-.10	.38	.61	-.05
Communicative Arts	.01	.47	-.72	-.03	.10	.10
Science	-.02	.85	-.05	.05	-.19	.20
Health Services	-.24	.21	-.28	.81	.02	-.20
Business	-.14	-.42	-.44	.32	-.14	-.41
Behavioral Science	-.17	-.08	.54	-.03	.30	.57
Social Science	-.62	-.04	.01	-.29	.02	.52
Performing Arts	.72	.42	-.15	.09	.03	.10
Computer Science	.05	.76	-.02	-.11	.20	-.28
Social Service	-.10	.15	.87	-.08	-.11	.10

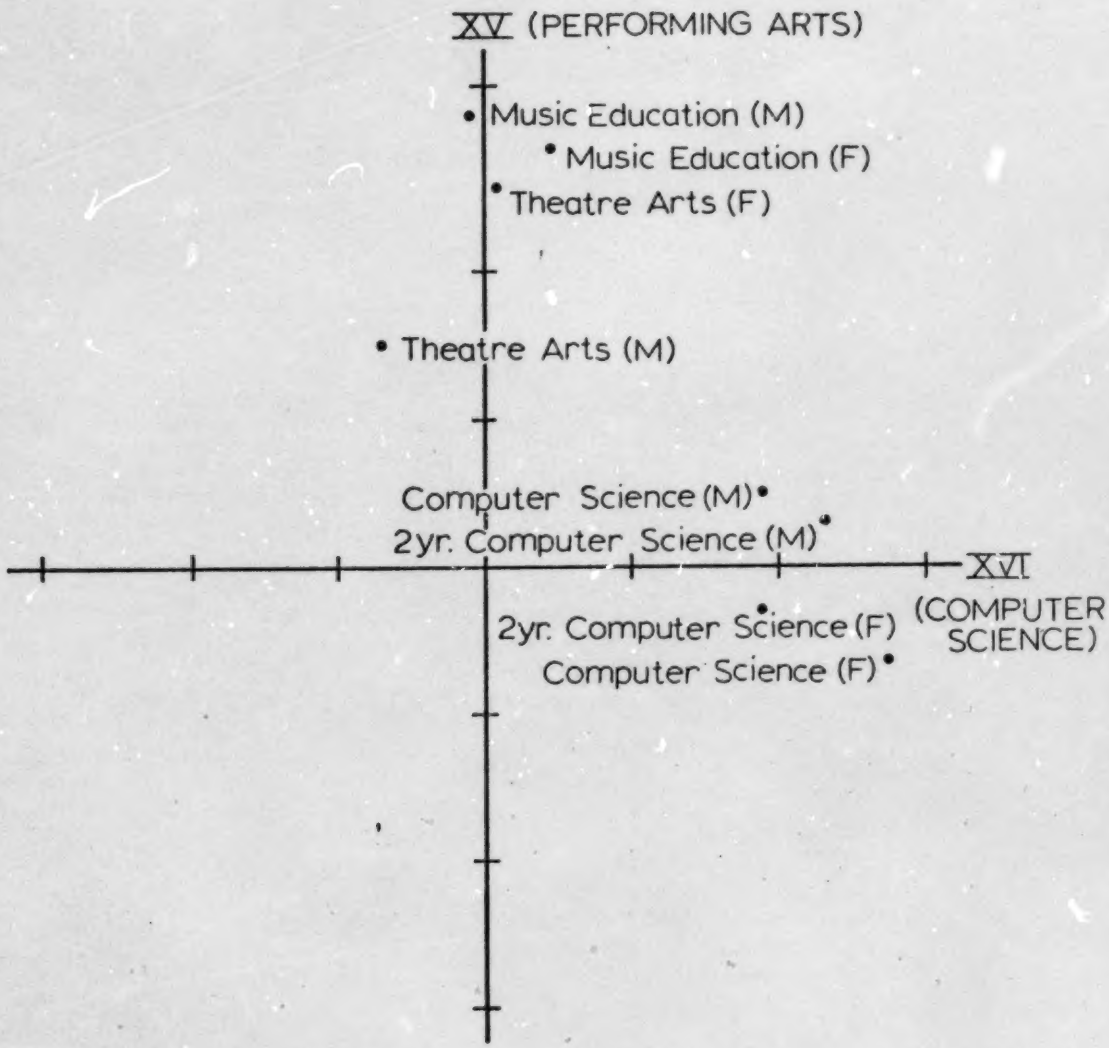

Figure 1. Plot of two obliquely rotated first-order clusters.

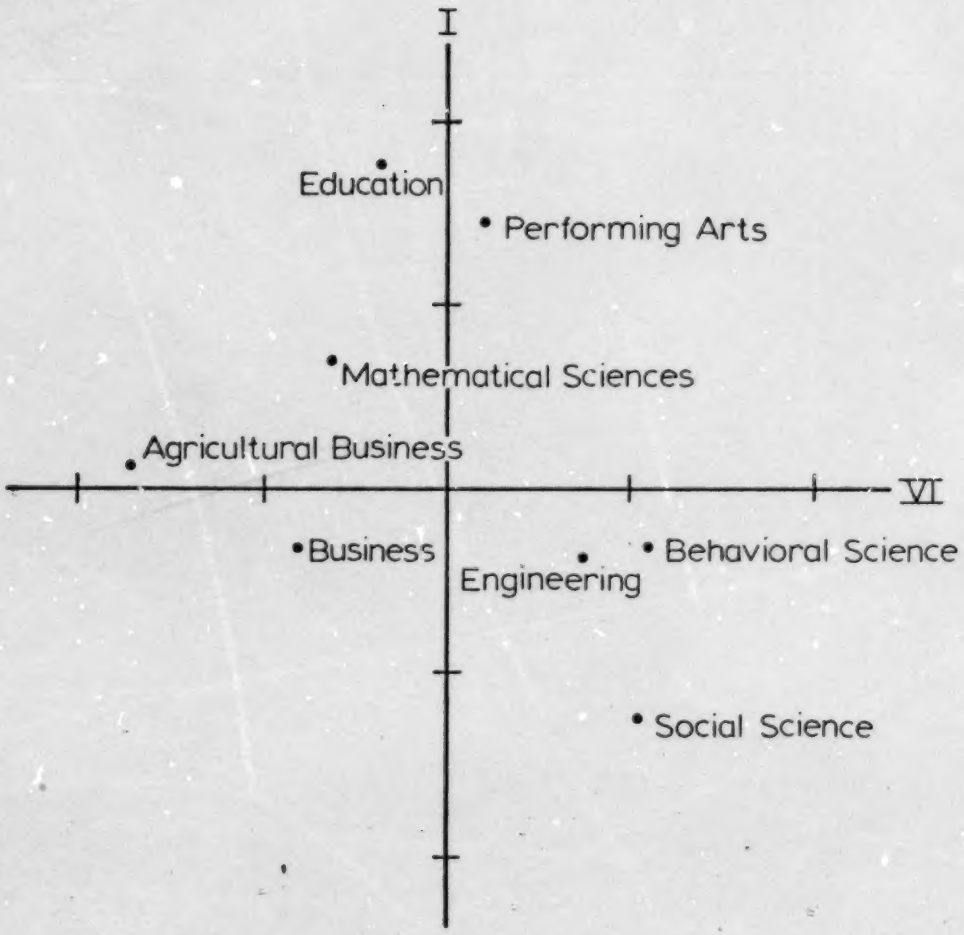

Figure 2. Plot of two varimax rotated second-order clusters.